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ABSTRACT

Improvement of academic achievement requires both changes in school organizational structures and in curriculum and instruction. This study investigates the assumption of giving "minds-on" opportunities to reflect and "hands-on" opportunities to experiment and tests whether moving beyond the textbook makes science class more engaging for middle school students. (Contains 67 references.) (YDS)

# Instructional Practices and Motivation During Middle School (With Special Attention to Science)

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**Instructional Practices and Motivation During Middle School (With Special Attention to Science)**

At the end of the 1980's, the dismal condition of middle grades education in the United States finally began to receive national attention. California was one of the first states to produce a task force report calling for middle grades reform (California State Department of Education, 1987). California's report, *Caught in the Middle*, was followed by a long line of reports from Florida (Florida Department of Education, 1988), Maryland (Maryland Task Force on the Middle Learning Years, 1989) Louisiana (Louisiana Middle Grades Advisory Committee, 1989), and at least 15 other states (Totten, Sills-Briegel, Barta, Digby, & Nielsen, 1996). At about the same time, foundations such as the Lilly Endowment (Clark, Bickel, & Lacey, 1993), Carnegie Corporation of New York (Carnegie Council on Adolescent Development, 1989), Edna McConnell Clark Foundation (Lewis, 1991, 1993), and the W.K. Kellogg Foundation (Mertens, Flowers, & Mulhall, 1998) began advocating and funding middle grades reform initiatives. Meanwhile, researchers began finding and reporting that the transition to middle grades schools was associated with declines in academic motivation and performance (e.g., Anderman & Anderman, 1999; Eccles & Midgley, 1989; Harter, Whitesell, & Kowalski, 1992; Simmons & Blyth, 1987; Seidman, Allen, Aber, Mitchell, & Feinman, 1994; Wigfield, Eccles, Mac Iver, Reuman, & Midgley, 1991). In a related finding, middle grades students perceive their middle-grades teachers as more remote and impersonal than their elementary teachers and are less certain that their middle school teachers care about them and know them well (e.g., Feldlaufer, Midgley, & Eccles, 1988; Midgley, Feldlaufer, & Eccles, 1989). Furthermore, this research indicated that student work completed in the first year of the middle grades was often less demanding than in the last year of elementary school, that academic expectations in middle grades schools were

generally low, and that students had few opportunities to learn important new concepts and apply them to real world problems (e.g., for a review, see Ames, 1998). These reports, initiatives, and findings -- along with the systematic nationwide dissemination of *Turning Points* (Carnegie Corporation Council on Adolescent Development 1989) -- prompted many schools and districts to institute a series of reforms in the middle grades over the last decade.

This ongoing middle grades reform movement is not occurring in a vacuum. It is concurrent with the standards-based reform movement that has also swept the United States since the late 1980s. Professional associations in each of the disciplines have attempted to specify what all students should know and be able to do (e.g., National Center for History in the Schools, 1994: National Council of Teachers of English and the International Reading Association, 1995; National Council of Teachers of Mathematics, 1989; Project 2061 of the American Association for the Advancement of Science, 1993). In turn, state departments of education and local districts have issued written "content standards", "curriculum frameworks", or "standards of learning" that (a) are usually loosely based on the professional associations' standards and (b) are meant to ensure consistency across classrooms and schools in teachers' expectations of what students should learn and how well they should learn it. Furthermore, state departments of education and/or local districts have often implemented assessment programs designed "to hold school systems, schools, administrators, and teachers accountable for students performing at standard" (Mizell, 1998, p. vii).

Both the middle grades reform movement and the standards-based reform movement share the goal of increasing student achievement and resolving student motivational problems by encouraging "research-based" instructional practices that (a) promote students' *understanding* and build *meaning* into their learning opportunities (Knapp, Marder, Adelmen, & Needels, 1995)

and (b) assist students in developing and maintaining optimal motivational levels (e.g., high interest, engagement, effort, and valuing of school subjects) and orientations (e.g., being task-focused rather than ego-focused) in the middle grades. The purpose of this paper is to identify some of these research-based instructional practices, practices that may promote positive changes in middle school students' motivational beliefs and orientations both generally and in science. In identifying changes in practice that can help students flourish in middle school and in science, we will both review the research of others and present data from our own ongoing program of research.

## What Works in Middle Grades Reform?

Reducing the use of "performance-focused" instructional practices that emphasize, competition, ability grouping, and students' relative ability can prevent some of the negative shifts in students' motivational beliefs that often occur upon transition to a middle grades school. For example, Anderman, Maehr, & Midgley (1999) studied the motivational changes displayed by students after the transition to middle school in one community served by two middle schools. Students who entered a performance-focused middle school came to devalue understanding (e.g., "I don't care whether I understand something or not, as long as I get the right answer.") and developed a preference for unchallenging work ("I like my work best when it is easy to get the right answer.") more than did the students who entered a mastery-focused school that offered all students challenging tasks, eliminated ability grouping, and had an inclusive student recognition program that based awards upon individual growth and development rather than relative performance. Similarly, Roeser, Midgley, & Urdan (1996) report that when middle school students perceive their school to be mastery-focused (e.g., "Teachers in this school want students to really understand their work, not just memorize it.") they become more mastery focused

themselves and develop higher academic self-efficacy (e.g., " I am certain I can master the skills taught in school this year.") In contrast, when middle school students perceive their school to be performance-focused they become academically self-conscious (experience more performance-related fear, nervousness, and embarrassment.)

Changes in practice that ensure that each student in a middle grades school will have more support from (and more meaningful relationships with) caring adults at the school can also reduce some of the negative shifts in students' motivational beliefs during the middle grades (Ames & Miller, 1994; Mac Iver & Plank, 1997). Schools-within-schools, looping (assigning teachers to the same students for two or three years), semi-departmentalization (e.g., assigning a teacher to teach two subjects to three class sections rather than one subject to six class sections) and interdisciplinary teaming are examples of structural reforms that have been made in many middle grades schools and that have been found to increase students' perceptions that their teacher cares about them and their learning and to strengthen teacher-student relationships (Arhar, 1997; Arhar and Kromrey, 1995; Felner, et al., 1997; Lipsitz, 1997; McPartland, 1987; 1990, 1992; MacIver, et al., 2000; Midgley & Urdan, 1996). In turn, when middle grades students perceive their teachers to care about them and their learning, they are more likely report that they try to do what their teachers ask them to do and to give their best effort in class (Wentzel, 1997) and are less likely to engage in risky behaviors (Resnick, et al., 1997).

However, changes in school organizational structures "are necessary but not sufficient for major improvement in academic achievement" (Hamburg, 2000, xii). That is, research in middle grades schools engaged in reform suggest major achievement gains are obtained only in schools that have implemented both changes in school organization (e.g. "create smaller learning environments," "form teams of teachers and students," "assign an adult advisor for every

student,") and in curriculum and instruction (e.g., "Transmit a core of common, substantial knowledge to all students in ways that foster curiosity, problem solving, and critical thinking"). For example, in a study of a group of 31 Illinois middle schools (Felner et al., 1997), schools that had made both structural and instructional changes that were consistent with *Turning Points'* recommendations achieved substantially better and displayed larger achievement gains over a two-year period than did similar schools that had implemented at least some of *Turning Point's* key structural changes but not changes in curriculum and instruction. Another study suggesting the critical importance of going beyond just structural changes in improving achievement was conducted in 155 middle grades schools in Michigan (Mertens, Flowers, & Mulhall, 1998). When these researchers analyzed outcomes in schools that had one of the key structural changes in place (interdisciplinary teams that were given high levels of common planning time), they found that achievement gains were much higher among the subset of these schools that had a received a grant from the Kellogg Foundation that made it possible for their teachers to engage more regularly in staff development activities focused on curriculum and instruction. In fact, there is even evidence from this study that staff development may be more important than common planning time in facilitating achievement gains. Schools whose teams had inadequate common planning (but had a grant that made frequent professional development possible) showed more achievement gains than did non-grant schools, even those non grant schools whose teams had high levels of planning time.

In identifying "what works" in middle grades reform, the literature suggests that providing students with more personalized and less-performance-focused learning environments and teachers with ongoing professional development that focuses directly on curriculum and instruction have an important impact on students' outcomes. These foundational practices help

create a serious, supportive, and task-focused learning environment for both students and teachers. But, this literature does not provide much guidance regarding the specific kinds of learning opportunities that optimize student motivation in particular subject areas. Let's suppose that a middle grades school has succeeded in providing its students with a more personalized and less-performance-focused learning environment and its teachers with regular time for professional development. What is the next step in ensuring that students give their best efforts in the major subjects? What specific kinds of learning opportunities must be created for students so that they become fully and productively engaged in every class? Because "the subject" matters, it is impossible to identify a generic answer that applies equally well to each major subject area (Stodolsky, 1998). In this chapter, we focus on science, but draw some lessons from science that may apply to other academic subjects in the middle grades.

## Moving Beyond the Textbook in Science Class: The Motivational Benefits of "Minds-on" and "Hands-on" Learning Opportunities

Both the *National Science Education Standards* (National Research Council, 1996) and the American Association for the Advancement of Sciences' *Benchmarks for Science Literacy* (Project 2061, 1993) enthusiastically embrace the goal of helping all middle grades students to become scientifically literate. In their instructional implications, these national standards and benchmarks "rest on the premise that science is an active process" (National Research Council, 1996, p. 4). For example, scientific literacy involves the ability to design and carry out experiments, interpret data from these experiments, and communicate those results to others in meaningful ways (Cheek, 1999). However, the opportunity to conduct hands-on experiments, while essential, is not enough. "Students must have 'minds-on' experiences as well" (National Research Council, 1996, p. 2). For example, students should have frequent chances to provide a

hypothesis to explain why something happened, offer opinions on scientific issues, suggest questions or topics for the class to investigate, and write in a personal science journal. Students also need the opportunity to read about and discuss current science-related news and to experience authentic science writing that is more engaging, current, and accurate than the poorly-written, superficial, and de-contextualized prose found in the typical textbook. Textbook reading is no substitute for reading scientific articles and book-length investigations of important science topics in order to complete written and oral reports.

Hands-on opportunities to experiment, minds-on opportunities to reflect, and use of curricular materials other than a textbook are rare in high-poverty middle school science classrooms (Wilson & Corbett, 1999). Students in high-poverty classrooms frequently receive instruction that is solely skills-focused, rather than a balanced instructional program that also includes meaning-oriented instruction that is active, reflective, and draws from a range of well-written sources (Knapp, 1995). Although there is remarkable consensus regarding the need to offer all students minds-on, hand-on, and mutifaceted learning opportunities in science, there is little empirical research regarding the motivational benefits of such instruction in science, especially middle school science.

## A Field Study in Two High Poverty Middle Schools

In the pages that follow, we report findings from a study we conducted to test the assumption that "minds-on" opportunities to reflect, "hands-on" opportunities to experiment, and movement beyond the textbook make science class more engaging and worthwhile for middle school students. For example, when students experience such opportunities frequently, are they more likely to believe that science class is interesting, useful, and educationally valuable? Do students view the provision of hands-on and minds-on activities as a clear sign that their science

teacher really cares about them and is doing his or her best to help them learn? Does the provision of such opportunities lead students to work harder to learn about science? We report the results of "value-added" longitudinal analyses that provide estimates of the impact of science instructional practices on each outcome after controlling for students' prior status on that outcome, using data collected from 63 classrooms in two high poverty middle schools attempting to implement standards-based instructional programs in science. These analyses will help us begin to flesh out how science teachers' instructional practices are associated with changes in student motivation.

Method

We employ hierarchical linear models (HLM) to investigate whether between-classroom differences in instruction are related to classroom-level differences in students' outcomes. Because HLM estimates effects at both the individual and classroom level, it permits the investigation of causes underlying systematic differences in classroom-level outcomes. For each of five motivational outcomes, we estimated a set of nested models using the deviance statistic to compare models and select the final model. A separate set of nested equations was used for each of the three instructional practices, thus we estimated 15 sets of nested models.

Data. The data come from a larger multi-disciplinary study of high poverty middle schools in Philadelphia. The study draws upon student surveys collected during the 1997-1998 and 1998-1999 school years in two schools. The surveys asked students about their exposure to a variety of instructional practices as well as their attitudes about science. The surveys are administered annually and, with a few exceptions, contain the same questions in both school years.

To study the relation between instructional practices and student motivation, one must have data drawn from classrooms that vary in their practices. In many samples, this presents a problem because it is difficult to find enough examples of classrooms using state-of-the-art instructional practices. However, in this sample, many teachers in both schools in this sample had received standards-based professional development and materials as part of the National Science Foundation's Urban Systemic Initiative in Philadelphia and as part of other middle school reform efforts. This makes it likely that there will be sizeable number of classrooms in these schools in which students experience regular mind-on learning tasks as well as opportunities to read beyond the textbook and to experiment.

Class-level measures of instructional practices during the 1998-1999 school year: A section's score on each class-level measure of instructional practices is the mean student score within that section on items that measure that aspect of instruction. For example, a section's score on the *Minds-on Learning Opportunities Scale* is the mean student score on a composite comprised of six survey items asking students to indicate how often their science teacher asked them to: "Provide a hypothesis to explain why something happened," "Offer your opinion on a scientific issue," Provide questions or topics for the class to investigate," "Explain answers to teammates or partners and check to make sure that all teammates or partners understand the material," "Discuss careers in science," and "Write in a personal science journal." Similarly, *Hands-On Opportunities to Design, Carry Out, and Interpret Experiments* was measured as the mean student score on a composite comprised of survey items indicating how often students: "Did an experiment," "Wrote about the results of an experiment you had done," "Explained the reasons for the results of an experiment," "Interpreted data from an experiment," "Watched the teacher do an experiment," and "Designed an experiment or part of an experiment." Finally, *Going Beyond the Textbook*, constructed in a parallel fashion to the measures above, is comprised of 3 items asking students to report how often they "Read other articles on science," "Did a written or oral report," and "Discussed a science news event." The response scale for each item in each scale was: Never (0), Once or twice a month (1), Once or twice a week (2), Most days (3), Every day (4).

Student-level measures of five positive outcomes during the 1998-1999 school year and the prior year. Although there are a wide variety of motivational constructs posited by various theorists, expectancy-value motivation theorists (e.g., Wigfield & Eccles, 2000) argue that students' achievement choices, effort, persistence, and learning in a class can be explained

largely by their expectations for success in the class (e.g., "Will I learn a lot in this class, if I choose to try?") and by their perceptions of the value of the class (e.g., "Is this class interesting, exciting, and enjoyable? Is it useful?). Expectancy-value theory also identifies some of the key influences on these expectations and values (e.g., students' previous achievement-related experiences, students' perceptions of teachers' beliefs and behaviors, students' goals and self-schemata). We embrace this perspective on achievement motivation and measure five expectancy-value constructs that we believe are key to understanding the impact of instructional practices on motivation and achievement in science class: expectancy for learning, intrinsic value, utility value, pedagogical caring, and effort.

*Expectancy for Learning* is measured by a single-item: "If I work hard in science class, I can learn a lot." (strongly disagree, strongly agree)

*Intrinsic Value* is measured by a 3-item z-score composite: "Science is exciting"(strongly disagree, strongly agree) "When I work in science class, it is because I'm really interested in the subject matter."(not at all a reason, a very important reason) "How much do you enjoy the work you do in your science class?" (not much at all, very much),

*Utility Value* is also measured by a 3-item z-score composite: "When I work in science class, it is because…the knowledge and skills are useful in my life, …it helps me prepare for high school, …it helps me prepare for a career." (not at all a reason, a very important reason)

According to most expectancy-value models of achievement, students' perceptions of teachers' beliefs and behaviors affect students' effort, engagement, goals, and values. In this regard, Wentzel (1997) and has presented evidence indicating that perceptions of "pedagogical caring" have an especially important impact on student motivation in middle school. That is, middle school students' engagement in and valuing of learning are increased when the students

believe that their teachers cares about them and their learning. We measure *Pedagogical Caring* with a 2-item z-score composite: "My science teacher cares about how we feel." (almost never, almost always), and "My science teacher does everything she or he can to help us improve our skills and increase our understanding" (almost never, almost always).

*Effort* is measured by a single item: "How hard are you working to learn about science?" (not hard at all, as hard as I can)

Results

Central tendency and between-classroom variation in instructional practices. The instructional practices we measured were used fairly frequently in the average classroom in our sample but there was abundant variation between classrooms. For example, as can been seen in Figure 1, there were five classrooms where minds-on activities rarely or never occurred, and over a dozen classrooms where they occurred once or twice a week or more. The grand mean of the Minds-On Learning Opportunities scale was 1.55 (i.e. across items and classrooms, the average minds-on learning opportunity in this sample occurred "more than twice a month" on a scale ranging from "never" to "every day.") The mean of the Hands-on Opportunities Scale was Identical to the Minds-On Scale ($\underline{M}$ = 1.55) and similar to that of the Beyond the Textbook Scale ($\underline{M}$ = 1.63). Each scale had a similar standard deviation ($SD_{MINDS\text{-}ON} = .48$, $SD_{HANDS\text{-}ON} = .51$, $SD_{BEYOND} = .47$) and range.

Predicting motivational outcomes based upon between classroom variation in instructional practices. We performed a parallel set of analyses for each of the five motivational outcomes and each of the three instructional practices. The main research question addressed was whether the instructional practices students experienced within their science class during the 1998-1999 school year were predictive of their motivational outcomes in Spring 1999 after

controlling for students' prior status on these outcomes in Spring 1998. Therefore, the main model specified for each motivational outcome was:

Level-1 Model: $y = \beta_0 + \beta_1 *$ (OUTCOME IN SPRING 1998) + r

Level-2 Model: $\beta_0 = \gamma_{00} + \gamma_{01} *$ (SEVENTH-GRADE SECTION) + $\gamma_{02} *$ (EIGHTH-GRADE SECTION) + $\gamma_{03} *$ (MULTI-GRADE SECTION) + $\gamma_{04} *$ ( *INSTRUCTIONAL PRACTICE SCORE)* + $u_0$

$$\beta_1 = \gamma_{10} + u_1$$

The model above specifies the outcome variable as a function of a classroom mean (the intercept), prior status, and a random error term at the student level. The classroom-level model specifies the classroom mean of the outcome variable, as a function of an intercept, grade of class (represented as a series of dummy variable with sixth-grade as the excluded reference category), a continuous instructional practice measure and a random error term. The classroom-level model also specifies that the prior status slope varies randomly across classrooms.

In each model, the estimate of greatest interest to us was the effect of the instructional practice ($\gamma_{04}$) expressed as a standardized coefficient. Table 1 lists this coefficient for each model estimated.

Insert Table 1 About Here

As shown in the first two rows of Table 1, both the frequency of minds on learning opportunities and the frequency of opportunities to go beyond the textbook were related strongly and positively to all five of the motivational outcomes. For example, a one-standard deviation change on the *MINDS-ON* instructional practice scale was associated with a .59 standard

deviation change in students' perceptions of the intrinsic value of science class ( $p < .001$) All of the standardized coefficients in these first two rows are moderately large (around .4) or very large (greater than .5).

In contrast, as shown in final row of Table 1, the frequency of opportunities to design, carry out, and interpret experiments (HANDS-ON) was related to only two of the five outcomes. Specifically, students who experienced HANDS-ON opportunities showed significantly greater growth in their ratings of the intrinsic value of science class and of the pedagogical caring displayed by their science teacher.

Grade level of class as a predictor of motivational outcomes. In some samples, students show systematic declines across the middle grades in their perceptions of the intrinsic and utility value of the tasks they are given in school and also report declines in expectancies, pedagogical caring, and effort (See Mac Iver & Plank, 1996; Wigfield & Eccles, 2000.) In this sample, however, grade level of class was not a significant predictor of students' motivational outcomes in science.

Prior status as a predictor of motivational outcomes. Students' scores on a motivational outcome during the prior spring was an important predictor of students' current score on that outcome ($p < .001$ in every model). The relation between prior and current motivation was strongest for the measures of intrinsic value (standardized $\gamma = .37$, $p < .001$), utility value (standardized $\gamma = .36$, $p < .001$), and effort (standardized $\gamma = .34$, $p < .001$) and weakest for measures of expectancy for learning (standardized $\gamma = .17$, $p < .001$) and pedagogical caring (standardized $\gamma = .23$, $p < .001$)

Sex differences. In other analyses, we tested for sex differences in students' motivational outcomes in science and checked to see whether the motivational benefits of these instructional practices were similar for boys and girls. Boys and girls did not differ in their ratings of effort, utility value, intrinsic value or pedagogical caring. However, girls were much more likely than boys to believe that if they worked hard in their science class, they would learn a lot (Effect Size=.43, p =.04). Finally, across all instructional practices considered in the field study, the motivational benefits of the instructional practices were not significantly different for boys than girls.

Conclusions From the Field Study

The analyses indicate that active, meaning-oriented instructional practices in science are associated with positive responses from students in high-poverty schools. For all three types of instructional practices considered, students receiving more frequent exposure to these practices in their science class were more likely to perceive the class as intrinsically valuable and to perceive their science teachers as caring and dedicated. Both minds-on opportunities and opportunities to read beyond the text -- but not hands-on opportunities to experiment – were predictive of students' expectancies for learning, perceptions of utility value and self-reported effort.

It is interesting that students did not expect to learn more (and learn more that is useful) when they were given frequent hands-on opportunities to experiment. We suspect that students may not fully realize what they are learning as they design, conduct, and interpret experiments. Not only are they learning the answer to a narrow research question (e.g., What does acid rain do to plants?), but they are also learning the scientific method, to recognize and weigh alternative explanations of events, and "to deal sensibly with problems that involve evidence, numbers, patterns, logical arguments and uncertainties." (Project 2061 of the American Association for the

Advancement of Science, 1993, p. XI) On the other hand, it is also possible that some of the experiments students designed, conducted, or interpreted were engaging but involved only trivial intellectual work that did not stretch students' understanding. "Without clear academic goals and an understanding of how to reach them, efforts to provide engaging and interesting activities are simply form without substance... Quality education is not simply about having students busy and happy in the classroom. It's about having them engaged in work that has intellectual teeth" (Berns, Kantrov, Pasquale, Makang, Zubrowski, & Goldsmith, 2000, p. 16).

The results of the field study are important because they helps build an evidentiary base-- to supplement the existing rhetorical base -- supporting the use of active, meaning-oriented instruction in science. Every science teacher wants his or her students to find science class engaging and educationally valuable. Every science teacher wants the students to perceive him or her as caring and dedicated. These results help inform teachers about the kinds of science instruction that may promote these valued outcomes.

## Active, Meaning-Oriented Instructional Practices in Other Subjects

Although other subject areas are organized differently than science and use somewhat different methods of inquiry and analysis, science education reformers are not the only ones calling for more use of active, meaning-oriented instructional practices. In fact, the value of practices such as these is currently being touted in each of the major subject areas.

One major thrust of current reforms in history education is to move away from traditional poorly-written history textbooks that cover so many facts, dates, names and events so trivially that the material is not intelligible (Tyson, 1999). Reformers are encouraging the use instead of narrative texts that tell history through meaningful stories (the memorable and compelling true tales of people and societies from the past), primary sources (Kohler, 1999), and hands-on and

minds-on instructional approaches (Garriott, 1999). The aim is for students to begin to understand the problematic nature of historical interpretation and analysis, to develop "an interpretative acumen that extends beyond 'locate information in the text' skills" (Wineburg, 1996, p. 433), and to appreciate the relevance of history for their everyday lives (Bransford, Brown, & Cocking, 1999).

Similarly, mathematics education reformers are criticizing traditional math classrooms in the United States where students learn terms and practice procedures; where teachers fail to elaborate content with explanations, demonstrations, or examples; where little attention is paid to lesson coherence (Stigler & Hiebert, 1999); and where students are given a large number of arbitrary contextless number problems and "let's pretend" word problems that are not related to each other (Becker, 1993). In contrast, teaching for understanding in mathematics involves developing students' number sense and conceptual understanding. It involves expanding the concept of basic skills to include explicit instruction and practice in estimation, mental math, and in the use of calculators, spreadsheets and other tools for doing mathematics. It involves giving students hands-on opportunities to use tangible objects to explore number concepts and to apply mathematics to meaningful everyday problems arising from students' interests, real-world data, and measurements that students make. It involves students being given minds-on opportunities to pose problems, to explain their reasoning and to respond to the reasoning of others as they attempt draw conclusions, to write about mathematics, and to address problems using multiple approaches (Becker, 1993; Bransford, Brown, & Cocking, 1999; National Council of Teachers of Mathematics, 1989; Willis, 1999, Zucker, 1995).

Similarly, current reform efforts in English Language Arts (e.g., Adelman, 1995; Ciardi, Kantrov, & Goldsmith, 2000; Plank & Young, 2000; National Council of Teachers of English

and International Reading Association, 1995; Needels, 1995) aim reading instruction at deeper understanding of a wide range of fiction and nonfiction literature from many cultures, periods, and genres and focus writing instruction on meaningful communication with real audiences. These reformers urge the use of minds-on instructional techniques designed to enable students to apply reading strategies and operations while engaged in the reading process, strengthen cognitive elaboration and comprehension skills, and enable students to acquire and benefit from knowledge of the author's craft. These reformers also recommend hands-on opportunities with authentic texts (e.g., reading to obtain guidance in performing a real-world task) and "gateway activities" that provide students with experiences that they would otherwise have to *imagine* in order to respond to a writing assignment, and that help them think in ways that will lead them to approach a particular writing task or a particular audience more effectively (e.g., Hillocks, 1995; Jones, 2000)

The jury is still out on whether active, meaning-oriented instructional practices will ever become the norm most days in most subjects in U.S. classrooms and whether these practices will produce consistent motivational benefits and increased achievement for all types of students. Recent evidence, though limited, certainly suggests that active, meaning-oriented practices have both motivational (e.g., Ginsburg-Block & Fantuzzo, 1998; Mac Iver & Plank, 1996; Shields, 1995) and achievement benefits (e.g., Plank & Young, 2000; Mac Iver, Plank, & Balfanz, 1997; Stigler & Hiebert, 1999; Knapp, Marder, Adelman, & Needels, 1995) even in high-poverty classrooms. In our opinion, it is important to follow up these promising findings with detailed practical research that helps us understand more fully the strengths and limits of such approaches and also types of materials, professional development, and in-classroom assistance that the typical teacher may need in order to use these approaches effectively.

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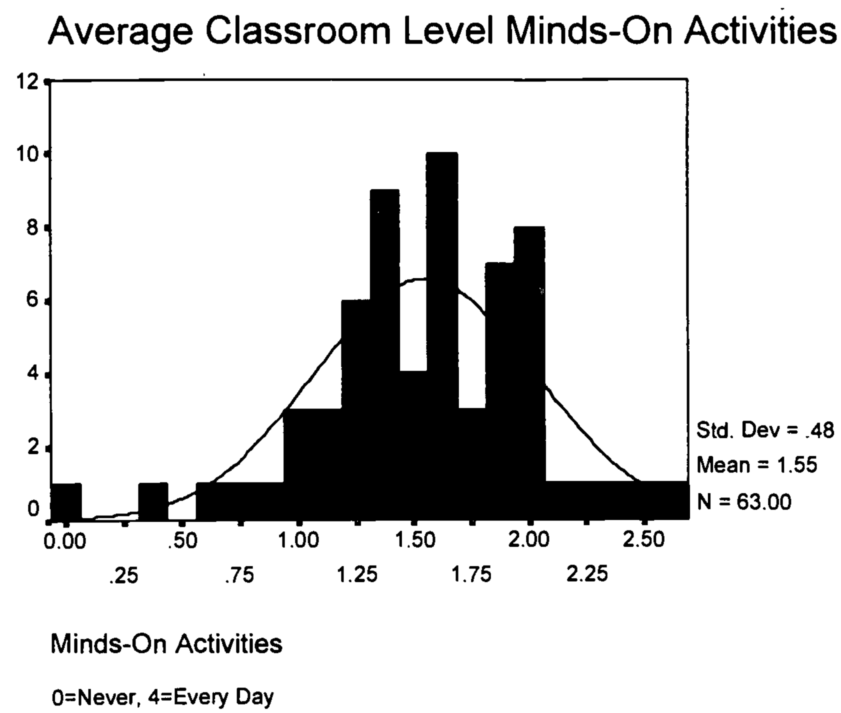
Average Classroom Level Minds-On Activities
12
10
8
6
4
2
0
0.00
.25
.50
.75
1.00
1.25
1.50
1.75
2.00
2.25
2.50
Std. Dev = .48
Mean = 1.55
N = 63.00
Minds-On Activities
0=Never, 4=Every Day

Table 1

Instructional Practices as Predictors of Motivational Outcomes in Science

| Class-Level Predictor: Frequency of… | Intrinsic value | Utility value | Expectancy for learning | Effort | Pedagogical caring |
|---|---|---|---|---|---|
| "Minds-On" Learning Opportunities | .59*** | .40* | .40* | .45* | .68*** |
| Going Beyond the Textbook to Read About Science | .65*** | .54** | .38* | .38~ | .69*** |
| Opportunities to Design, Carry Out, And Interpret Experiments | .43** | .16 | .19 | .31 | .33* |

*Note.* Standardized gamma coefficients are shown. The coefficient in each cell is from an HLM model that includes prior status on the motivational outcome as a student-level predictor and grade level of class as a class-level predictor. ~ $p = .06$ * $p < .05$ ** $p < .01$ *** $p < .001$

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